(12) UK Patent Application (19) GB (11) 2 358 934 (13) A

(43) Date of A Publication 08.08.2001

(21) Application No 0100741.8

(22) Date of Filing 11.01.2001

(30) Priority Data
(31) 00026070 (32) 05.02.2000 (33) GB

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(51) INT CL^7
G01R 31/02

(52) UK CL (Edition S)
G1U UR3102
U1S S1027

(56) Documents Cited
GB 2278548 A GB 0848180 A GB 0782290 A
WO 90/11532 A WO 00/46607 A JP 050273293 A
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(58) Field of Search
UK CL (Edition S) G1U UR19145 UR3102 UR3108 UR3112 , H2K KSX
INT CL^7 G01R 19/145 31/02 31/08 31/12

(54) Abstract Title

Cable Testing

(57) Apparatus 3 for testing an electrosurgery cable 2 is connected between the cable and a conventional electrosurgery power supply 1. A first sensing node 42 has a connector 45 at one end connected to the active electrode 21 at the patient end 22 of the cable 2. A second sensing node 43 has an electrode 47 movable along the insulation 23 of the cable 2. The apparatus 3 measures current at the active electrode 21 in order to detect any damage to the cable conductor 24, and measures leakage current through the insulation 23 to detect damage to the insulation.

Fig.1.

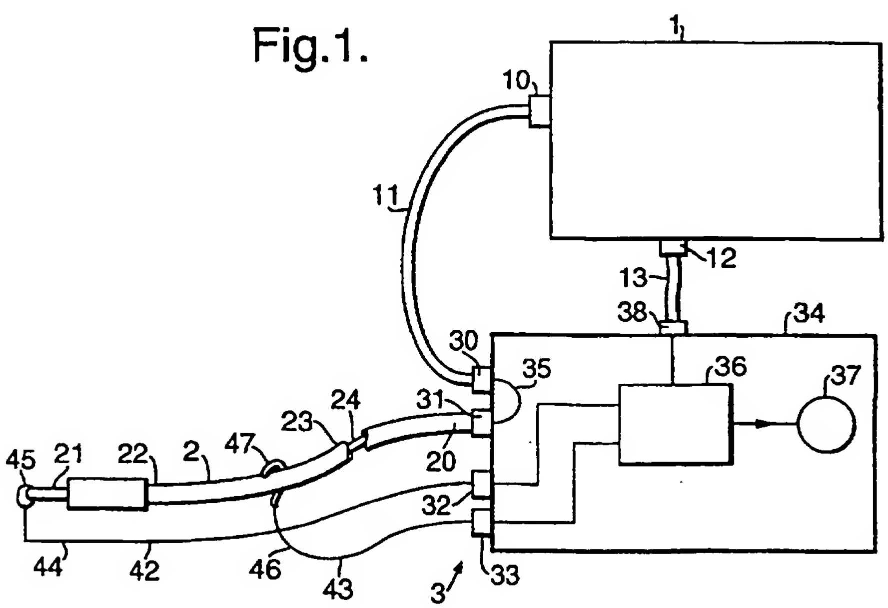

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Fig.1.

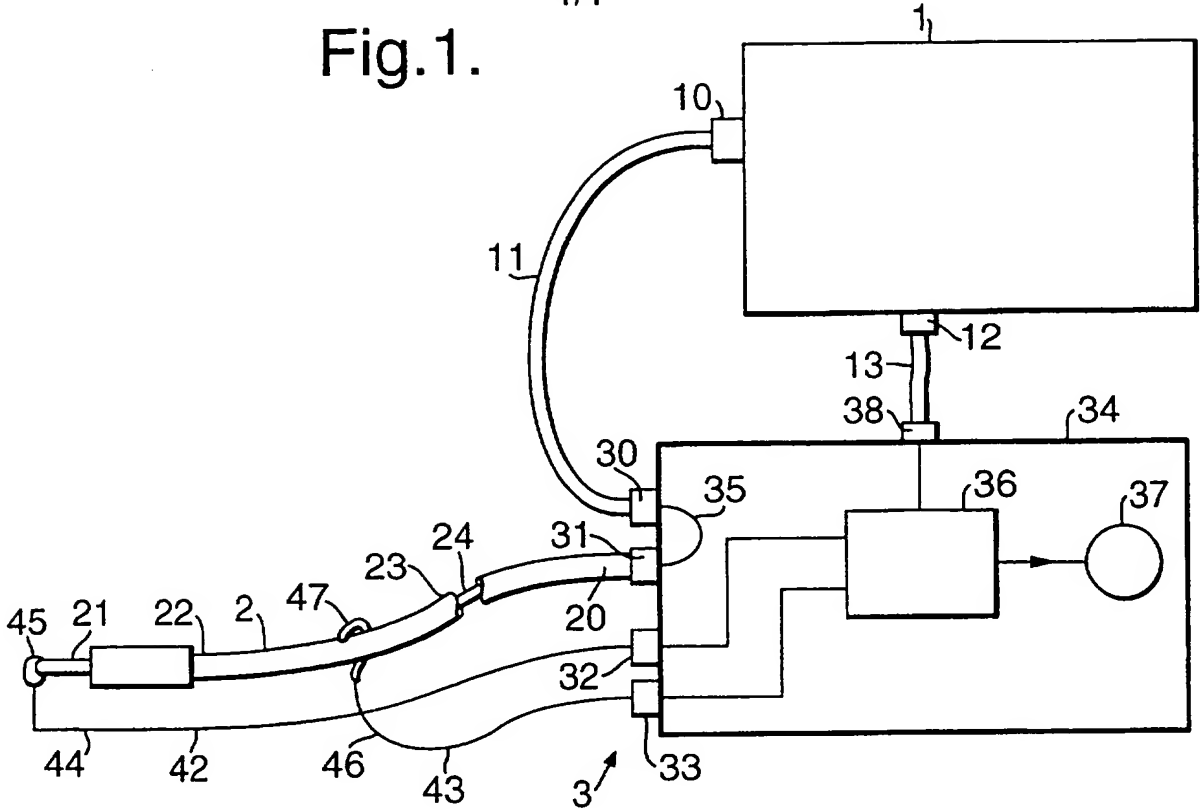


Fig.2.

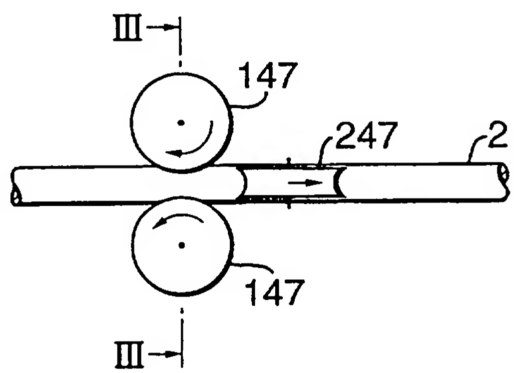
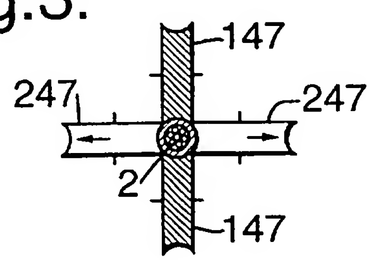


Fig.3.



CABLE TESTING

This invention relates to cable testing.

The invention is more particularly concerned with apparatus and methods for testing cables used with electrosurgery apparatus.

Electrosurgery cables pass high frequency energy to a surgical site and must safely pass high currents and voltages. The cables are subject to wear during use and during sterilization. Damage to the insulation of the cable can lead to leakage of current causing possible danger to the user or patient, or it could cause incorrect operation of the electrosurgery unit. Similarly, damage to the conductors within the cable may prevent correct power being delivered at the surgical site, it may also cause heating of the cable. Cables may be disposed of routinely after a number of uses, to reduce the risk of a damaged cable being used. This, however, can lead to waste if functioning cables are disposed of unnecessarily. Also, cables subjected to excessive wear may be used longer than is desirable.

It is an object of the present invention to provide apparatus and a method by which cables can be tested.

According to one aspect of the present invention there is provided apparatus for testing an electrosurgery cable used with a power supply unit by which a voltage is applied to the cable, the apparatus including a node for locating along the cable, means for detecting

current flow from the node when the power supply unit applies a voltage to the cable, and means for indicating when current flow from the node is indicative of a fault in the cable.

The node may be adapted for connection to a conductor at the patient end of the cable and the means for indicating may be arranged to indicate when a reduction in current flow from the node is indicative of damage to the conductor. Alternatively, the node may be adapted for moving along insulation of the cable and the means for indicating may indicate when current flow from the node is indicative of breakdown of the insulation. The node may be in the form of a loop embracing the cable. Alternatively, the node may include a conductive pad slidable along the cable or a pair of wheels that can be run along the cable. In such an arrangement, preferably, the node would have two pairs of wheels arranged at right angles to one another. The apparatus preferably includes two nodes one of which is adapted for moving along the insulation of the cable and the other of which is adapted for connection to the conductor at the patient end of the cable. The cable is preferably connected with an output of the power supply via the apparatus, the apparatus also being connected with a plate output of the power supply.

According to another aspect of the present invention there is provided a system of an electrosurgery power supply unit and apparatus according to the above one aspect of the invention.

According to a further aspect of the present invention there is provided a method of testing electrosurgery cables used with a power supply unit, including the steps of making a connection between an output of the power supply unit and one end of the cable, detecting

current flow from a location along the cable when the power supply unit applies a voltage to the cable, and indicating when current flow from the location along the cable is indicative of a fault in the cable.

The current flow may be detected by making a connection with a conductor of the cable towards its patient end, a fault being indicated if current is below a predetermined threshold. Alternatively, current flow may be detected by moving an electrode along insulation of the cable, a fault being indicated when current flow to the electrode is indicative of a breakdown of the insulation. Preferably, the method includes the steps of both making a connection to a conductor of the cable towards its patient end and moving an electrode along the cable to detect breakdown of its insulation.

An electrosurgery system including apparatus and a method of detecting faults on a cable, in accordance with the present invention, will now be described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 shows the system schematically;

Figure 2 is a side elevation view of a modified electrode for the system; and

Figure 3 is a transverse cross-section view of the modified electrode along line III-III of Figure 2.

With reference first to Figure 1, the system includes a conventional electrosurgery power supply unit 1, an electrosurgery cable 2 and cable testing apparatus indicated generally by the numeral 3.

The electrosurgery unit 1 has active and plate output ports 10 and 12 respectively interconnected by cables 11 and 13 with inlet ports 30 and 38 on the testing apparatus 3. The testing apparatus 3 also has outlet ports 31, 32 and 33 connected respectively with the machine end 20 of the electrosurgery cable 2 and with two current sensing nodes 42 and 43 the operation of which will be described later. Within the housing 34 of the testing apparatus 3, there is a direct connection 35 between the inlet port 30 and the first outlet port 31 so that power from the electrosurgery unit 1 is supplied via this connection to the machine end 20 of the cable 2. The apparatus 3 includes a current measuring unit 36 having three inputs connected to the ports 32, 33 and 38 and having an outlet connected to an indicator 37.

The first sensing node 42 comprises a wire 44 connected at one end to the port 32 and having a connection 45 at its other end connected to the active electrode 21 at the patient end 22 of the electrosurgery cable 2. The connection 45 differs according to the shape of the electrode 21, it may be a socket or a spring clip or the like. In this way, the first node 42 interconnects the active electrode 21 at the patient end of the cable 2 with an input of the current measuring unit 36.

The second node 43 comprises a wire 46 connected at one end with the port 33 and at its opposite end with a curved loop electrode 47 embracing and movable along the outer

insulation 23 of the cable 2. This connects via the port 33 with the second input of the current measuring unit 36.

The cable testing apparatus 3 is used in two modes: the first is to test the continuity of the central, active conductor 24 in the cable 2; the second is to test the integrity of the cable's insulation 23.

In the first mode, the electrosurgery unit 1 is turned on and set to provide its maximum output current. This current flows along the cable 2 via the connection 35 and along the first node 42 via the connection 45. If the conductor 24 of the cable 2 is intact, a large current flows along the full length of the cable to the electrode 21. This is passed along the node 42 and is detected by the current measuring unit 36, which accordingly provides a first type of appropriate indication on the indicator 37 to show that the cable conductor 24 is intact. It will be appreciated that the indicator 37 could take various different forms and may be a visual or audible indicator. If the conductor 24 is broken or damaged, this will reduce current flow, which will be detected by the unit 36 and a fault indication provided on the indicator 37.

In the second mode, the electrosurgery unit 1 is set to provide its maximum output voltage, which appears between the conductor 24 in the cable 2 and the second node 43. The curved electrode 47 of the node 43 is passed along the length of the cable 2 in contact with its outer insulation 23. If the insulation 23 is intact, only a small leakage current flows through that part of the cable 2 between its machine end 20 and the location of the sensing electrode 47 and via the second node 43. In this case, the current measuring unit 36 provides

no output to the indicator 37, which accordingly provides a second type of indication to indicate that the insulation 23 is intact. If, however, the insulation 23 is damaged or faulty a large current flows and the indicator 37 provides the first type of indication, that is, of a problem.

The entire testing apparatus 3 could be incorporated in a hand-held probe including the connection point 45 for the electrode 21 at the patient end 22 of the cable 2 and the electrode 47 for testing the insulation 23. The apparatus 3 is also preferably arranged to indicate if a cable cannot carry the maximum output current produced by the electrosurgery unit.

The insulation testing electrode could take other forms. For example, it could be conductive foam rubber pads clamped onto and slidable along the cable. Alternatively, as shown in Figures 2 and 3, the electrode could have two pairs of conductive wheels 147 and 247 arranged at right angles. The two pairs of wheels 147 and 247 are spaced from one another a short distance along the cable 2 so that both can fully contact the cable and so that the entire circumference of the cable is contacted as the wheels are run along the cable.

The present invention involves testing a cable at the maximum current and voltages produced by the actual electrosurgery unit with which it is to be used. This avoids stressing the cable by repeated testing to unnecessarily high voltages and currents. The invention enables cables to be tested reliably, thereby reducing the risk that a faulty cable will be used. It can also reduce wastage and costs by avoiding automatic precautionary disposal of cables after a set number of uses.

CLAIMS

1. Apparatus for testing an electrosurgery cable used with a power supply unit by which a voltage is applied to the cable, wherein the apparatus includes a node for locating along the cable, means for detecting current flow from the node when the power supply unit applies a voltage to the cable, and means for indicating when current flow from the node is indicative of a fault in the cable.

2. Apparatus according to Claim 1, wherein the node is adapted for connection to a conductor at the patient end of the cable, and wherein the means for indicating is arranged to indicate when a reduction in current flow from the node is indicative of damage to the conductor.

3. Apparatus according to Claim 1, wherein the node is adapted for moving along insulation of the cable, and wherein the means for indicating is arranged to indicate when current flow from the node is indicative of breakdown of the insulation.

4. Apparatus according to Claim 3, wherein the node is in the form of a loop embracing the cable.

5. Apparatus according to Claim 3, wherein the node includes a conductive pad slidable along the cable.

6. Apparatus according to Claim 3, wherein the node has a pair of wheels that can be run along the cable.

7. Apparatus according to Claim 6, wherein the node has two pairs of wheels arranged at right angles to one another.

8. Apparatus according to any one of the preceding claims including two nodes, one of which is adapted for moving along the insulation of the cable and the other of which is adapted for connection to the conductor at the patient end of the cable.

9. Apparatus according to any one of the preceding claims, wherein the cable is connected with an output of the power supply via the apparatus, and wherein the apparatus is also connected with a plate output of the power supply.

10. Apparatus substantially as hereinbefore described with reference to the accompanying drawing.

11. A system of an electrosurgery power supply unit and apparatus according to any one of the preceding claims.

12. A system substantially as hereinbefore described with reference to the accompanying drawing.

13. A method of testing electrosurgery cables used with a power supply unit, including the steps of making a connection between an output of the power supply unit and one end of the cable, detecting current flow from a location along the cable when the power supply unit applies a voltage to the cable, and indicating when current flow from the location along the cable is indicative of a fault in the cable.

14. A method according to Claim 13, wherein current flow is detected by making a connection with a conductor of the cable towards its patient end, and wherein a fault is indicated if current is below a predetermined threshold.

15. A method according to Claim 13, wherein current flow is detected by moving an electrode along the insulation of the cable, and wherein a fault is indicated when current flow to the electrode is indicative of a breakdown of the insulation.

16. A method according to Claim 13 including the steps of both making a connection to a conductor of the cable towards its patient end and moving an electrode along the cable to detect breakdown of its insulation.

17. A method substantially as hereinbefore described with reference to the accompanying drawing.

18. Any novel and inventive feature or combination of features as hereinbefore described.

Application No: GB 0100741.8
Claims searched: 1 - 17
Examiner: Robert C Mumford
Date of search: 11 April 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): G1U UR19145, UR3102, UR3108, UR3112, H2K KSX

Int Cl (Ed.7): G01R 19/145, 31/02, 31/08, 31/12.

Other: Online EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2278548 A	(CONMED CORP) see figs 1 to 10 and page 3 line 13 to page 4 line 12.	1 and 2 at least
X	GB 848180	(OKONITE) see whole document	1, 3, 5-7, 13,15 at least
X	GB 782290	(BRITISH INSULATED) see whole document	1, 3-4 at least
X	WO 00/46607	(GENERAL ELECTRIC) see fig 1, and page 2 line 25 to page 3 line 20	1, 3,
X	WO 90/11532	(RAYCHEM LTD) see fig, page 2 line 24 to page 3 line 22, page 6 lines 29-30, and page 7 line 1 to page 8 line 24.	13-14 at least
X	JP 5273293	(MITSUBISHI) see abstract	13 at least
X	US 5684408	(KING) see figs 1 to 11 col 3 lines 1 to 30, and col 6 line 41 to col 7 line 10.	1, and 2 at least
X	US 4581577	(NOWOSAD) see figs 1 to 4, and col 4 line 55 to col 5 line 9.	1 and 2 at least

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family
A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.

Application No: GB 0100741.8
Claims searched: 1 - 17

Examiner: Robert C Mumford
Date of search: 11 April 2001

Category	Identity of document and relevant passage	Relevant to claims
X	US 3857091 (CONTINENTAL COPPER) see whole document	13, and 14 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
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